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$R$, in the center around the residence. The difference in the area of the *entire rectangular* tract and the *sum* of the areas of the two square fields, $F$, $F$, is 187½ acres. Give the dimensions and area of the entire tract, and one square field, $F$.

# QUERIES AND INFORMATION.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

## A POSTULATE OF THE HYPOTHESIS OF THE FOURTH DIMENSION.

*Let it be granted that a straight line may be drawn through any point of the space in which our universe is contained, every other point of the supposed straight line being outside of our space.*

This is *a postulate* logically involved in Arthur Willink's speculation respecting a fourth direction. He says that the fourth direction is *unknown.* He reasons that this could not be if two points in the fourth direction were posited in our space, since two given points in a straight line determine its position, and its direction becomes known.

According to Arthur Willink the direction of the fourth dimension is *unknown.* Hence, the fourth dimension can intersect our space in but *one* point. Hence, every other point on the hypothetical fourth dimensional straight line except that of the intersection must lie outside of our trinally extended space. Practically to the denizens of our universe that means that a straight line may be drawn where our space is not. This hypothesis of a fourth dimension, therefore, places restrictions upon the extent of our space, whereas no ultimate boundary is assigned to it by either the intellect or the imagination of man. The human mind reports as the result of its cognition *one illimitable space.* The hypothesis of another and a wider space is inconsistent with this cognition.

Let us view this subject in another light. Three straight lines mutually perpendicular to each other may be drawn through any point in our space, and hence through the point in which the fourth dimension is supposed to intersect it. The third dimension is perpendicular to the plane of the first and second dimensions. If this plane is definitely located, the direction of the third dimension is determined. Is the fourth dimension, also, at right angles to this plane? If so it must coincide with the third dimension and therefore lie in our space. But this conclusion contradicts the hypothesis that the fourth dimension is not in our space.

Finally, if the alleged fourth dimension is not perpendicular to the plane of the first and second dimensions is it a *legitimate* dimension?

JOHN N. LYLE.

The derivitive of $e^{-xi}(\cos x+i\ \sin x)$ is zero.

$\therefore\ e^{-xi}(\cos x+i\ \sin x)=A$, a constant.

Putting $x=0$, $A=1$.

$\therefore\ e^{xi}=\cos x+i\ \sin x$.

Wm. E. Heal, Marion, Indiana.

In $e^{xi}=\cos x+i\ \sin x$, let $x=m\pi$. $\therefore\ e^{m\pi i}=\cos m\pi+i\ \sin m\pi$. $\therefore\ m\pi i=\log[\cos m\pi+i\ \sin m\pi]$. If in this $m$ is any positive or negative integer. the last term, $i\ \sin m\pi$, will disappear; and we may write: $m\pi i=\log\cos m\pi$. Now for any *even* number form, $\cos m\pi$ becomes $+1$, for any *odd* $-1$. $\therefore\ \log\cos m\pi=\log(\pm1)$. $\therefore\ m\pi i=\log(\pm1)$. For $m=1$, $\pi i=\log(-1)$. We may then write: $m\log(-1)=\log(\mp1)$ [Cf. *Schurig's Algebra*, 73, 2.z.]. The upper sign is to be taken for $m$ even, the lower for $m$ odd.

If $u=e^x$, $\log(\pm u)=\log u+\log(\pm1)=\log e^x+\log(\pm1)=x+m\log(-1)$. The sign to be taken as before.

Oscar Schmiedel, A. M., Professor of Mathematics,
Bethany College, Bethany, West Virginia.

WANTED.—A solution by Quaternions, giving the elementary steps in simple English, of some problem published in the Monthly.

A Reader.

Olney, in his *General Geometry*, says "The problem of the duplication of the cube and the trisection of an angle has been shown to be identical, as both depend upon the insertion of two means in a continued proportion between two extremes." Where can I find a proof of the statement in reference to the trisection of an angle?

N. F. Davis, 21 George Street,
Providence, Rhode Island.

(A) The trisection of an angle: *The trisection of a right line taken as the chord of any arc of a circle trisects the angle of the arc;* (B) Duplication of the Cube: *Doubling the dimensions of a cube octuples its contents, and doubling its contents increases its dimensions twenty-five plus one per cent.*

By request of the author,
Edw. J. Goodwin, Solitude, Indiana.

## DEFINITION OF A FRACTION.

I. In compliance with your request in September No. (1894) of Monthly, I state that my preference of definitions of fractions is (B).

H. W. Draughon.

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II. I think that a fraction is an indicated division. Division has two meanings: 1, The division into parts; 2, The division by a number of the same kind. A group of 12 cows÷4=a group of 3 cows. 12 cows÷4 cows=3 times as many. H. C. WHITAKER.

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III. The definition (A) suits me the best if only applied to "abstract" arithmetic—provided, the meaning of "a unit" is defined in advance. But as the sentence reads: "a unit or anything else," it leaves a suspicion in my mind that all mathematicians have not a fixed definition for a unit in the scientific sense. To get at what a mathematical fraction is, we must first all agree on a common basis for numeric systems. I submit my views. First, notation of any kind, or the symbols (figures) we call numbers, have *no value other* than that given by the "something" the numbers represent; second, every numerical system is founded on three principles, viz: singularity, plurality, and totality. The first principle is represented by the so-called *indefinite* one. All indefinite ones represent, in the scientific sense, indivisible fractions, of utility only in counting "items." From these indivisible ones *units* are raised, that is, the least "plural" (the second principle) is obtained by composing two of the indivisible ones into one united whole. This, the first and lowest unit, is called two. Again, by uniting the lowest unit and the indivisible fraction into a greater whole, called three, the least numeric total (the third principle) is expressed.

According to this conception of numbers, a multitude of fractions are convertible into units of divers magnitude and from a number of units, a multitude of fractions or finite ones can be evolved, but every unit used in computation *must have a fixed*, *definite*, *intrinsic* value (its magnitude) as well as a relative value depending on its combination with other units and fractions.

With this understanding of what constitutes the foundation for all scientific numerical systems (not applicable to empiric systems), the definition of a fraction may be reduced to this :—A fraction is a given part of a given unit the magnitude of which is called the denominator, and is written under a line, while the given part or parts of the unit's magnitude is written above the line and is called the numerator; hence, the numerator indicates the fraction of a certain unit designated by the denominator.

CHAS. DE MEDICI,
60 West 22d Street, New York City.

[We give all our subscribers opportunity to express *their* views *briefly* upon the questions raised in the MONTHLY whether these views are founded upon what we consider right conceptions or not. EDITORS.]

NOTE ON HELMHOLTZ'S USE OF THE TERMS "SURFACE" AND "SPACE" AS IDENTICAL IN MEANING:—Does the "immortal" Helmholtz in his Lectures on the—"Origin and Significance of Geometrical Axioms"—use the terms "surface" and "space" as identical in meaning?

If so, is not his performance "plainly pseudological" however "sickening" the statement of the fact may be to the devotees who would have us bow down before their pseudo-spherical idol and reverence their pseudological prophet as an infallible authority. JOHN N. LYLE.

## COMMENTS ON DUREGE'S THEORY OF FUNCTIONS.

Durege's book is admirably adapted for introducing beginners to the theory of functions according to the methods of Riemann. Ever since its first appearance, I have been in the habit of recommending it to my students.

PROFESSOR DR. L. FUCHS,
September 5th, 1895. University of Berlin.

His (Durege's) success lies in his art of execution; the material chosen with rare skill is worked up into a continuous whole and treated with masterly lucidity, and the interest is constantly kept up by happy examples. The present work, the fourth edition, which was prepared by Durege shortly before his death, is excellently adapted for an introduction to the study of complex variables. Beginning with the historical development of the idea of complex quantities, the author first establishes the general properties of functions of such quantities. * * * Durege's book will certainly maintain for a long time to come the prominent position in literature which it occupies at present.

*Zeitschript fur das Realschulwesen*, 1894.

An instructive book, in which is developed according to the ideas of Cauchy, and especially of Riemann, the classical theory of a complex or imaginary variable. The examples are simple and well chosen. * * * A good manual for students.

*Revue Generale des Sciences Pures et Appilquces*, 1894.

A new edition of Dr. Durege's most excellent book, well known to every mathematician, lies before us. Compared with the third edition, only a few changes appear, consisting in short additions, more numerous examples, and alterations in style. * * * The excellencies of Durege's presentation of the elements of the theory of functions are so generally known, that they relieve the reviewer in a most agreeable way of making any commendation or criticism. We have no book which is so well adapted for the introduction to the more recent theory of functions, and for facilitating the study of the works of that great mathematician (Riemann), as the one here noticed.

*Naturwissenschaftliche Wochenschript*, 1894.

The fourth edition of the present work has now appeared, which fact is a conclusive proof of its excellence. As this edition, compared with the third, contains only a few changes, consisting in short additions, more numerous examples, alterations in style, etc., we may dispense with a more minute discussion of it. The work is based upon the modern theories of functions following Riemann's method, and is eminently adapted to introduce the student to the conceptions of this great mathematician—whom it is quite difficult to understand in the original. The present work has full raison d' etre of Neumanns book "Vorlesungen

uber Riemann's Theorie der Abelschen Integrale," and it is even to be recommended to a beginner in preference to the latter on account of its greater precision.
*Central Organ fur die Interessen des Realschulwesens*, 1894.

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## EDITORIALS.

No. 10, Vol. II, of the *Mathematical Magazine* is expected to be ready in January, 1896.

Prof. William Hoover should have been credited with solving Problem 17, Average and Probability. His solution was accidentally mislaid.

D. G. Durrance sent in a solution of Problem 49, Department of Arithmetic, after the July-August number had gone to press. His solution is by Algebra.

Drs. W. W. Beman and D. E. Smith have written a *Plane and Solid Geometry* which is being published by Ginn & Co. Something new and original may be expected.

Dr. G. A. Miller requests us to state that his position in Michigan University was an instructorship instead of a professorship. On account of his travels during the summer he failed to see the error until recently.

Prof. J. R. Baldwin has resigned his position as Professor of Mathematics in the Davenport Business College to accept a position at an increased salary in the Commercial Department in the High School of Davenport, Iowa.

Dr. Zerr notified us some time ago that his solution of Problem 43, Department of Geometry, is wrong. It does not follow from (3) and (4) that $y=z^2$. Professor Scheffer has pointed out the same error. We shall be pleased to publish a correct solution of this problem in the next issue of the MONTHLY.

We take pleasure in announcing that Drs. G. E. Fisher and I. J. Schwatt, of the University of Pennsylvania, have in press a translation of Durege's Theory of Functions of a Complex Variable, with special reference to Riemann surfaces. Durege's book is considered the standard text-book on the Theory of Functions. See comments on this book under Queries and Information.

The latest venture in the field of mathematical journalism in this country is the *American Mathematical Monthly*, edited by Profs. B. F. Finkel and J. M. Colaw, and issued monthly at $2. a year. The second volume is in progress and the double number for July and August, 1895, is at hand. The VISITOR heartily wishes the plucky editors the success they so richly deserve.
*The Mathematical Visitor*, 1895.